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EXAMINER

LEUNG, RICHARD L

ART UNIT	PAPER NUMBER
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3744

DATE MAILED: 07/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/734,948	Applicant(s) KAMIMURA ET AL.	
	Examiner Richard L. Leung	Art Unit 3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☒ Claim(s) 1 and 3 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because of minor informalities. It is suggested that --non-azeotropic refrigerant mixture-- be inserted after the word "safe" on line 6, and that the word "a" at the end of line 8 be deleted. Correction is required. See MPEP § 608.01(b).
2. The disclosure is objected to because of the following informalities: "Fig. 2," on page 11, line 12 is understood to be --Fig. 3 -- and "gas cooler 140," recited on page 11, line 18 is understood to be --gas cooler 120 --. Appropriate correction is required.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the plurality of evaporators required by claims 7 and 8 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement

Art Unit: 3744

sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claim 1 is objected to because of minor grammatical informalities. It is suggested that the phrase "a carbon dioxide" be changed to --carbon dioxide--, and "combustible refrigerants" be changed to --combustible refrigerant--. Appropriate correction is required.
5. Claim 3 is objected to because of the following informalities: the limitation, "and having a temperature glide," is already recited by claim 1 from which claim 3 depends. It is suggested that this limitation be removed from claim 3. Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear whether the plurality of evaporators required by claim 7 are to *replace* the evaporator already included by claims 4-6 from which claim 7

Art Unit: 3744

depends, or are *in addition to* the evaporator already included. Claim 7, when dependent on claim 6, is further indefinite because it is unclear which evaporator must be operated at the triple point temperature of carbon dioxide.

8. Claims 5 and 6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The phrase "hyper critical state" as recited in the claims does not appear to be a term widely recognized in the art, nor is it clearly defined in the specification. As best understood, the phrase "hyper critical state" shall be treated as being equivalent to --supercritical state-- in this action. However, clarification regarding "hyper critical state" will still be needed to overcome this rejection.

9. Claim 8 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claim recites the phrase, "outlet side of the evaporator," on the last line. However, it is unclear to which evaporator the claim is referring because the claim depends on claim 7, which introduces a plurality of evaporators.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Richard et al. (US-5736063). Richard et al. discloses non-azeotropic refrigerant compositions

Art Unit: 3744

containing carbon dioxide and at least one kind of combustible refrigerant. Example 51 in Table 2 discloses a specific refrigerant composition containing carbon dioxide and a combustible hydrocarbon, propane. Example 27 in Table 2 discloses a specific refrigerant composition containing carbon dioxide and a combustible HFC refrigerant, HFC-32. It is understood that non-azeotropic mixtures inherently exhibit a temperature glide.

12. Claims 1-4 are rejected under 35 U.S.C. 102(b) as being anticipated by Powell et al. (US-6117356). Powell et al. discloses a non-azeotropic refrigerant composition that comprises carbon dioxide (column 2, line 30) and at least one kind of combustible refrigerant such as HFC R-32 (column 2, lines 61-67) and hydrocarbon pentane (column 4, lines 27-43). It is understood that non-azeotropic mixtures inherently exhibit a temperature glide. It is additionally disclosed that the refrigerant composition may be used in a refrigeration system comprising an evaporator, a heat radiator (condenser), a compressor, and an expansion valve (column 2, lines 24-28). It is inherent that a refrigerant path connects the components of the refrigeration system.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 4, 7/4, and 8/7/4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Radermacher et al. (US-5092138) in view of Richard et al. (US-

Art Unit: 3744

5723063). Radermacher et al. disclose, with particular reference to the figure, a refrigerating device comprising a refrigerating cycle in which a compressor 4, a heat radiator (condenser 5), an expansion mechanism (not labeled, but depicted schematically at the bottom of the figure), and an evaporator (low-temperature evaporator 1) are connected by a refrigerant path. It is further shown that there is a second evaporator (high-temperature evaporator 2) in series connection with the low-temperature evaporator 1, and an auxiliary heat exchanger 3 that is arranged between the outlet side of the heat radiator 5 and the inlet side of the expansion mechanism and between the outlet side of the evaporator 2 and the inlet side of the compressor 4.

Although the refrigerating device disclosed by Radermacher et al. uses mixed refrigerants (see columns 2 and 3), some of which contain the ozone-depleting HCFC, chlorodifluoromethane (also known as HCFC-22 and R-22), the reference fails to disclose the carbon dioxide refrigerant mixture required by the claims. Richard et al. teaches the use of non-azeotropic refrigerant compositions containing carbon dioxide and at least one kind of combustible refrigerant, as already discussed above regarding claims 1-3. Accordingly, it would have been obvious to one of ordinary skill in the art to use in the refrigerating system disclosed by Radermacher et al. the refrigerant compositions taught by Richard et al. because Richard et al. teach that such compositions are suitable replacements for chlorodifluoromethane (column 3, lines 31-32) that will not deplete the ozone layer.

15. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Karl (US-6178761 B1) in view of Powell et al. (US-6117356). Karl discloses a refrigerating cycle

Art Unit: 3744

that uses a carbon dioxide refrigerant comprising a compressor 4, a heat radiator 8, an expansion mechanism 10, and an evaporator 11, all of which are connected by a refrigerant path. It is disclosed that the refrigerant used in this system is subjected to a supercritical state (column 1, line 66) inherently at a high-pressure side of the evaporator, which as best understood, is equivalent to a "hyper critical state," as recited by the claim. Karl fails to disclose the use of the mixed refrigerant required by the claim. Powell et al. teaches the use of non-azeotropic refrigerant compositions containing carbon dioxide and at least one kind of combustible refrigerant such as pentane, as already discussed above regarding claims 1-4. Accordingly, it would have been obvious to one of ordinary skill in the art to use in the refrigerating system disclosed by Karl the refrigerant mixture taught by Powell et al. because Powell et al. teaches that non-azeotropic mixtures exhibit a temperature glide which can be exploited to reduce the energy needed to operate a heat transfer device in the refrigerating system (column 5, lines 28-33). Alternatively, Powell et al. further teach that the addition of a combustible hydrocarbon to the refrigerant such as butane or pentane will aid in transporting any lubricant in the circuit back to the compressor (column 4, lines 27-43). Therefore, it would have also been obvious to add pentane or butane to the carbon dioxide refrigerant disclosed by Karl as taught by Powell et al., and thereby produce the refrigerant mixture required by the claim, for the purpose of dissolving and transporting any lubricating oil in the circuit.

16. Claims 7/5 and 8/7/5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Karl (US-6178761 B1) in view of Powell et al. (US-6117356) as applied to claim 5

Art Unit: 3744

above, and further in view of Radermacher et al. (US-5092138). The combination of Karl and Powell et al., as already discussed above, demonstrates a refrigerating system comprising a heat radiator, an expansion mechanism, and an evaporator that are connected by a refrigerant path, in which a non-azeotropic mixture comprising carbon dioxide and at least one kind of combustible refrigerant is used and subjected to a supercritical state. The combination fails to demonstrate a plurality of evaporators, wherein a low temperature evaporator and a high temperature evaporator are arranged in series, as required by the claims. Radermacher et al. teach a refrigeration device using a mixed refrigerant working fluid that comprises a low-temperature evaporator 1 arranged in series with a high-temperature evaporator 2. It would have been obvious to one of ordinary skill in the art to modify the refrigeration system demonstrated by the combination of Karl and Powell et al. to include the plurality of evaporators taught by Radermacher et al. because Radermacher et al. teach that such an arrangement can be used in devices wherein two separate compartments can be kept at different temperatures (column 2, lines 26-29). Claim 8 requires an auxiliary heat exchanger specifically placed in the refrigeration circuit. Karl already discloses such a heat exchanger E.

17. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Karl (US-6178761 B1) in view of Powell et al. (US-6117356) and Vander Woude et al. (US-6631621 B2). The combination of Karl and Powell et al., as already discussed above, demonstrates a refrigerating system comprising a heat radiator, an expansion mechanism, and an evaporator that are connected by a refrigerant path, in which a non-

Art Unit: 3744

azeotropic mixture comprising carbon dioxide and at least one kind of combustible refrigerant is used and subjected to a supercritical state. The combination fails to demonstrate that the evaporator is operated at the triple point of carbon dioxide as required by the claim. Vander Woude et al. teaches a refrigerating system, which can use carbon dioxide as the cryogen (refrigerant), wherein there is an evaporator coil 42 for vaporizing the cryogen. It is taught by Vander Woude et al. that preferably the evaporator coil is maintained (by a pressure regulator) at a state equal to or slightly above the triple point of the refrigerant. See column 5, lines 29-35. It would have been obvious to one of ordinary skill in the art to operate the evaporator demonstrated by the combination of Karl and Powell et al. at the triple point of carbon dioxide taught by Vander Woude et al. because, as understood, the triple point represents the lowest temperature and pressure at which the refrigerant can exist in the liquid phase and therefore provide the greatest cooling power in the evaporator.

18. Claims 7/6 and 8/7/6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Karl (US-6178761 B1) in view of Powell et al. (US-6117356) and Vander Woude et al. (US-6631621 B2) as applied to claim 6 above, and further in view of Radermacher et al. (US-5092138). The combination of Karl, Powell et al. and Vander Woude et al., as already discussed above, demonstrates a refrigerating system comprising a heat radiator, an expansion mechanism, and an evaporator, operated at the triple point of carbon dioxide, that are connected by a refrigerant path, in which a non-azeotropic mixture comprising carbon dioxide and at least one kind of combustible refrigerant is used and subjected to a supercritical state. The combination fails to demonstrate a

Art Unit: 3744

plurality of evaporators, wherein a low temperature evaporator and a high temperature evaporator are arranged in series, as required by the claims. Radermacher et al. teach a refrigeration device using a mixed refrigerant working fluid that comprises a low-temperature evaporator 1 arranged in series with a high-temperature evaporator 2. It would have been obvious to one of ordinary skill in the art to modify the refrigeration system demonstrated by the combination of Karl, Powell et al., and Vander Woude et al. to include the plurality of evaporators taught by Radermacher et al. because Radermacher et al. teach that such an arrangement can be used in devices wherein two separate compartments can be kept at different temperatures (column 2, lines 26-29). Claim 8 requires an auxiliary heat exchanger specifically placed in the refrigeration circuit. Karl already discloses such a heat exchanger E.

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- a. US-4987751 Lewen 01-29-1991: discloses a refrigeration device comprising a compressor, condenser (radiator), expansion device, and a plurality of evaporators that uses a non-azeotropic refrigerant mixture with a temperature-glide.
- b. US-5245833 Mei et al. 09-21-1993: discloses an air conditioning system with evaporator, compressor, condenser (radiator), expansion device, and an auxiliary heat exchanger.
- c. US-5598717 Sakamoto et al. 02-04-1997: discloses an air conditioner system with compressor, indoor and outdoor heat exchangers (evaporators and radiators), and an expansion mechanism that uses a non-azeotropic mixture refrigerant.

Art Unit: 3744

d. US-5752392 Kushiro et al. 05-19-1998: discloses an air conditioner with a plurality of evaporators and radiators, a compressor, an expansion mechanism, and an auxiliary heat exchanger that uses a mixed refrigerant.

e. US-6591618 B1 Howard et al. 07-15-2003: discloses a supercritical refrigeration system wherein a refrigerant, which may be carbon dioxide, is compressed to a supercritical state prior to expansion.


20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard L. Leung whose telephone number is 703-306-4154. The examiner can normally be reached on Mon-Fri.

21. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Denise L. Esquivel can be reached on 703-308-2597. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

22. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Richard L. Leung
Examiner
Art Unit 3744

rl


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